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Abstract

PRELIMINARY STUDY OF A FUEL REPROCESSING PILOT PLANT

by

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Recently a group of engineers from Noratom A.S., Boris Kidrič Institute of Nuclear Sciences, and Institutt for Atomenergi have made in co-operation a preliminary design study of a fuel-reprocessing pilot plant. The present paper is a short description of the work performed.

The purpose of the reprocessing facility is: (1) to reprocess fuel of some experimental reactors, (2) to develop fuel reprocessing of a future power reactor, (3) to gain experience and technical "know-how" in the field of fuel reprocessing.

The pilot plant is primarily designed for aqueous reprocessing of natural and/or low-enriched metallic uranium, canned in pure or alloyed aluminium or magnesium. However, oxide fuels in stainless steel or Zircalloy could also be treated by a "chopping and leaching" dissolution technique. The anticipated fuel burn-up is 3000-7000 MWD/t, and the cooling-time about 120 days. The nominal plant throughput is 1 kg U per hour, but if necessary, it can be increased.

The basic chemical flowsheet is an adopted Purex process consisting of chemical (or mechanical) decanning and dissolution of fuel, two extraction cycles for uranium and plutonium, "tail-end" uranium purification and auxiliary processes (i.e. waste treatment, acid and solvent recovery). In the extraction flowsheet, backcycling of the second cycle waste solutions is provided. Further, to increase the decontamination and concentration

of the plutonium product, a reflux flowsheet has been selected for the second plutonium cycle, or, as an alternative, an amine extraction of plutonium.

The chemical flowsheets developed in the present study are used as a basis for the plant design. However, the design is made sufficiently flexible to permit process variations within wide limits.

The main process equipment includes one dissolver, nine extraction columns, four evaporators, several towers (for acid absorption and rectification, steam-stripping), equipment for uranium "tail-end" treatment and solvent recovery. This equipment is contained in six shielded cells located in the central part of the main building. The main building also includes a "hot" and a "cold" wing, with auxiliary facilities. In addition to the main building, two small buildings are provided, one for waste storage and the other for transformers and compressors.

An economic evaluation which includes the estimated investment cost and the direct annual operating cost is presented.